

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-196341

(43)Date of publication of application : 15.07.1994

(51)Int.Cl.

H01F 31/00

H01F 37/00

(21)Application number : 04-342664

(71)Applicant : TAIYO YUDEN CO LTD

(22)Date of filing : 22.12.1992

(72)Inventor : KAINO DAISUKE  
KOJIKI MANABU

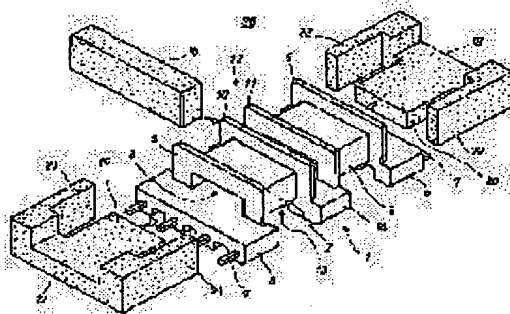
## (54) WINDING COMPONENT

## (57)Abstract:

PURPOSE: To obtain a small size thine high inductance by inserting an I-shaped core perpendicular to a winding axis of a spool body on a base of an intermediate engaging frame between two frames, opposing legs of centers of two E-shaped cores to engaging holes, and inserting them to form a closed magnetic path in a square shape with a cross inside.

CONSTITUTION: A winding is formed on a coil bobbin 1 which has an intermediate engaging frame 12 formed of two frames 10, 11 opposed in parallel at a predetermined interval via a spool body 2, and a base 14 for supporting the frame 12 having a crossover part 13 for bridging the winding between separated both winding parts in a bottom. Then, an I-shaped core 16 perpendicular to a winding axis of the body 2 on the base 14 of the frame 12 is inserted between the two frames 10 and 11.

Central legs 19, 20 of two E-shaped cores 17, 18 are opposed to an engaging hole 3 to be inserted, and corresponding central legs 19, 20 and side legs 21, 22 of both physical magnetic centers are brought into physical contact with the I-shaped core to form a closed magnetic path in a square shape with an inside cross.



## LEGAL STATUS

[Date of request for examination] 25.07.1996

[Date of sending the examiner's decision of rejection] 08.12.1998

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

\* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] While fitting the core of the I character configuration which intersects perpendicularly with the roller of a winding frame main part on the pedestal of the aforementioned middle fit-in frame in the coil bobbin characterized by providing the following between the two aforementioned collars the magnetic leg of the center of each of the core of the shape of two E typeface — the aforementioned fit-in — the coil parts characterized by forming the rice field typeface-like closed magnetic circuit by fitting in a hole face to face the fit-in in which a core is fitted inside — the winding frame main part which has the coil section by which a coil is wound outside while a hole is formed The fit-in frame which fastens the aforementioned winding frame main part at both ends. The pedestal in which the pin terminal was arranged while supporting both [ these ] the fit-in frame respectively. The pedestal which supports the middle fit-in frame which consists of two collars which fasten a winding frame main part and confront each other in parallel at the predetermined intervals while dividing the coil section in the center of abbreviation of the aforementioned winding frame main part, and the aforementioned middle fit-in frame with which the passage section which passes a coil to both coil sections by which division was carried out [ aforementioned ] was prepared in the bottom.

[Claim 2] fit-in of a coil bobbin according to claim 1 — the coil parts characterized by forming the closed magnetic circuit of the Japan Wood Pattern Manufacturers Association configuration with the core of the I character configuration which the magnetic leg fitted in a hole face to face is a magnetic leg of one way each of the core of two U type configurations, and was fitted in between two collars of the aforementioned middle fit-in frame

---

[Translation done.]

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001] [Industrial Application] This invention relates to coil parts, such as a small transformer mounted in the circuit board of electronic equipment, and a choke coil.

[0002] [Description of the Prior Art] In recent years, the consumer needs of small and highly-efficient-izing to electronic equipment etc. are strong, and its voice which asks for highly efficient-ization (a high inductance and quantity allowable-current value) is strong [ a transformer a choke coil, etc. which are the coil parts which occupy comparatively large capacity in the electronic parts carried in an electronic-circuitry substrate in connection with this attaining small and thin shape-ization ].

[0003] For example, a transformer is used with a converter, an inverter, etc., fits the core which consists of a magnetic material etc. in the coil bobbin with which the coil was wound, is constituted by fixing by the fastener etc. further, and serves as parts with large capacity compared with other electronic parts by which surface mounting is inevitably carried out to an electronic-circuitry substrate.

[0004] On the other hand, using the core of the magnetic material in which what has the large allowable-current value  $\text{imax}$  large and generally has the predetermined effective permeability although, as for coil parts, the inductance  $L$  is called for as highly efficient coil parts as compared with the capacity, when the resonance cross section of a coil is fixed, the following relational expression is realized in approximation.

[0005]  $L=N^2$  and  $\text{mue}=A/y$  however the  $\text{mue}$ : effective permeability,  $N$ : number of turns,  $A$ : resonance cross section,  $y$ : (Inductance) It is necessary to make [ many ] the number of turns  $N$  of the coil which winds an inductance  $L$  around a coil bobbin for enlarging so that clearly from the effective magnetic-path length above-mentioned relational expression, or to shorten the effective magnetic-path length  $y$ .

[0006] Next, the structure of a small transformer is explained in full detail based on drawing 6 and drawing 7 as a type of the conventional coil part structure.

[0007] Drawing 6 is the decomposition perspective diagram showing the coil bobbin of the above-mentioned conventional small transformer, and the structure of a core.

[0008] The coil bobbin 41 is formed around drawing by carrying out the fabricating operation of the synthetic resin etc. with metal mold etc. namely, the fit-in to which the coil section 43 around which coils, such as an enameled wire, are wound is formed in the periphery section of the winding frame main part 42 which has the shape of a square plaster, and a core (for example, central magnetic leg 51 of the core 50 which has the shape of a below-mentioned E typeface) is fitted in the interior -- penetration formation of the hole 44 is carried out

[0009] This side and back of the aforementioned winding frame main part 42 -- respectively -- the [ the first fit-in frame 45 and ] -- it prepares so that 2 fit-in frames 46 may fasten the winding frame main part 2 in the first half -- having -- \*\*\* -- being appropriate -- alike -- the [ the aforementioned winding frame main part 42, the first fit-in frame 45, and ] -- the abbreviation bobbin configuration is formed from 2 fit-in frames 46

[0010] under the present circumstances, the aforementioned fit-in -- as for a hole 44, the coil bobbin 41 is really cast -- the [ the first fit-in frame 45 and ] -- opening formation is carried out also at 2 fit-in frames 46

[0011] the [ furthermore, / the aforementioned first fit-in frame 45 and ] -- 2 fit-in frames 46 -- a near side -- the first pedestal 47 -- moreover, the second pedestal 48 installs in a back side, respectively -- having -- \*\*\* -- fit-in of each pedestals 47 and 48 -- a hole -- the side of a direction -- fit-in -- the pin terminal 49 protrudes on this side right-angled in the position parallel to a hole 3

[0012] the core 50 combined with the above-mentioned coil bobbin 41 on the other hand -- an E typeface-like core (it is also hereafter called E type core.) -- it is -- this E type core 50 after winding a coil -- two pieces -- facing each other -- each central magnetic leg 51 -- fit-in -- while being fitted in a hole 44, the side magnetic leg 52 by the side of the winding frame book outside of the body is also joined physically mutually collectively

[0013] Drawing 7 is the perspective diagram of the small transformer 40. In drawing, the small transformer 40 winds a coil 46 around the coil bobbin 41 which protruded the pin terminal 49, and has tucked it up to the predetermined pin terminal. next, the central magnetic leg 51 of two

E type cores 50 -- fit-in of the coil bobbin 41 -- it inserts in a hole 44 face to face, and the side magnetic leg 52 is located out of a coil, and it has structure which joined physically the nose of cam of each side magnetic leg 52 (EE type structure)

[0014] In addition, generally the transformer which replaced the above-mentioned E type core by U type core of a U character configuration is also used (UU type structure).

[0015] Furthermore, the transformer (E) type, U type structure) of structure which does not join another side in the center of a winding frame main part as an I type core of an I character configuration by making one side into E type core or U type core, but is joined on one pedestal is also developed.

[0016]

[Problem(s) to be Solved by the Invention] However, to the demand of highly-efficient-izing (raise in an inductance) of coil parts, and small and thin-shape-izing, when effective-permeability  $\text{mue}$  is decided by the quality of the materials (a permalloy, a dust core, ferrite, etc.) of a use core and number of turns  $N$  are made [ many ], \*\*\* becomes thick and will be contrary to the demand of thin-shape-izing.

[0017] Moreover, in coil parts, a direct-current superposition property becomes a problem. When number of turns  $N$  are increased, this property deteriorates and it becomes impossible to pass current not much in coil parts, although change of the weighted solidity when generally [ this direct-current superposition property ] adding a direct current is said. The value of the allowable-current value  $\text{imax}$  over a predetermined inductance value is equivalent to the direct-current superposition property of coil parts (refer to drawing 5 ).

[0018] since the field of the coil section of a winding frame main part will become short if the effective magnetic-path length  $y$  is shortened, without it, on the other hand, changes number of turns  $N$  -- an equivalent inductance -- obtaining -- in piles -- not winding -- it does not obtain, but \*\*\* will become thick and will be inevitably contrary to thin shape-ization

[0019] It offers the coil parts excellent in the direct-current superposition property which can obtain a high inductance, this invention being made in view of the above-mentioned situation, and attaining small and thin shape-ization.

[0020]

[Means for Solving the Problem] the fit-in in which, as for this invention, a core is fitted inside -- with the winding frame main part which has the coil section by which a coil is wound outside while a hole is formed The fit-in frame which fastens the aforementioned winding frame main part at both ends, and the pedestal in which the pin terminal was arranged while supporting both [ these ] the fit-in frame respectively. The middle fit-in frame which consists of two collars which fasten a winding frame main part and confront each other in parallel at the predetermined intervals while dividing the coil section in the center of abbreviation of the aforementioned winding frame main part. The pedestal which supports the aforementioned middle fit-in frame with which the passage section which passes a coil to both coil sections by which division was

carried out [ aforementioned ] was prepared in the bottom, While fitting the core of the I character configuration which intersects perpendicularly with the roller of a winding frame main part on the pedestal of the aforementioned middle fit-in frame in the coil bobbin \*\*\*\* between the two aforementioned collars the magnetic leg of the center of each of the core of the shape of two E typeface --- the aforementioned fit-in --- by fitting in a hole face to face, the above-mentioned purpose is attained by offering the coil parts characterized by forming the rice field typeface-like closed magnetic circuit

[0021] moreover, fit-in of the aforementioned coil bobbin --- the magnetic leg fitted in a hole face to face is a magnetic leg of one way each of the core of two U type configurations, and the above-mentioned purpose is attained by offering the coil parts characterized by forming the closed magnetic circuit of the Japan Wood Pattern Manufacturers Association configuration with the core of the I character configuration fitted in between two collars of the aforementioned middle fit-in frame

[0022]

[Function] two collars which confront each other in parallel the predetermined interval prepared in the middle fit-in frame in this invention --- the coil section of a winding frame --- fit-in, since it has divided with the hole the core (I type core is called below) of the I character configuration fitted in between two collars which stand face to face against above-mentioned parallel --- physical --- fit-in --- with the magnetic leg of the center of each of the core of the two shape of an E typeface fitted in the hole face to face, and a side magnetic leg, it joins in the shape of a rice field typeface, and a closed magnetic circuit is constituted Therefore, branching of a magnetic path is attained and effective magnetic-path length becomes short.

[0023] Moreover, similarly, in the same combination as the above with two U type cores and I type cores, a Japanese typeface-like closed magnetic circuit is constituted, branching of a magnetic path is attained, and effective magnetic-path length becomes short.

[0024] Therefore, the direct-current superposition property of having excelled since the high inductance was obtained without increasing number of turns is acquired.

[0025] Furthermore, since the passage section which passes a coil to both coil sections divided by the pars basilaris ossis occipitalis of a middle fit-in frame pedestal is prepared, it is possible to wind a coil around a series at both the coil section, without producing a level difference.

Therefore, when a coil is wound over both the coil section, a coil swells in a part for a middle fit-in frame pedestal, and \*\*\*\* does not increase.

[0026]

[Example] The example of this invention is explained in detail based on a drawing.

[0027] The decomposition perspective diagram and drawing 2 which show the structure of the small transformer as an example of the coil parts concerning this invention in drawing 1 are the perspective diagram of a small transformer which the coil was wound [ perspective diagram ] in this example, it tucked [ perspective diagram ] up to the input/output terminal, and you inserted [ perspective diagram ] the core, and made it complete.

[0028] the fit-in in which, as for the small transformer 30, a core is fitted inside in both drawings --- with the winding frame main part 2 which has the coil section by which a coil is wound outside while a hole 3 is formed The fit-in frames 5 and 6 which fasten the aforementioned winding frame main part 2 at both ends, and the pedestals 8 and 9 in which the pin terminal 7 was arranged while supporting both [ these ] the fit-in frame respectively. The middle fit-in frame 12 which consists of two collars 10 and 11 which fasten the winding frame main part 2 and confront each other in parallel at the predetermined intervals while dividing the coil section in the center of abbreviation of the aforementioned winding frame main part 2. The pedestal 14 which supports the aforementioned middle fit-in frame 12 with which the passage section 13 which passes a coil 35 to both coil sections by which fragmentation was carried out [ aforementioned ] was formed in the pars basilaris ossis occipitalis, While fitting in the core 16 of the I character configuration which intersects perpendicularly with the roller of the winding frame main part 2 on the pedestal 14 of the aforementioned middle fit-in frame 12 after winding a coil 35 around the coil bobbin 1 which \*\*\*\* between the two aforementioned collars 10 and 11 each central magnetic legs 19 and 20 of the cores 17 and 18 of the shape of two E typeface --- the aforementioned fit-in --- by

fitted in a hole 3 face to face It has the structure where the central magnetic legs 19 and 20 to which both cores correspond physically, and the side magnetic legs 21 and 22 joined to I type core physically respectively, and the rice field typeface-like closed magnetic circuit was formed. In addition, the aforementioned coil bobbin 1 makes phenol resin etc. the quality of the material, and is really formed by carrying out molding processing of this synthetic resin with metal mold etc.

[0029] In the small transformer 30 of the above-mentioned structure, when I type core 16 minds so that clearly from the plan with which each core of (A) of drawing 4 was put together, a closed magnetic circuit branches and a bird clapper understands the effective magnetic-path length y short. Effective magnetic-path length y' of the small transformer 40 of the conventional EE type structure is shown in this drawing (B) as comparison.

[0030] Coil parts have a large inductance L as mentioned above as compared with the capacity. And the present when what has the large allowable-current value imax is called for as highly efficient coil parts. Under the conditions which cannot do the resonance cross section of a coil greatly for small and thin-shape-izing, using the core of the magnetic material which generally has the predetermined effective permeability In the following approximation, there is the method of making [ many ] the number of turns N of the coil which winds an inductance L around a coil bobbin for enlarging, or shortening the effective magnetic-path length y so that clearly.

[0031] (Inductance) If number of turns N are increased as pointed out on L=N<sup>2</sup> and mue-A/y (however, the mue: effective permeability, N: number of turns, A: resonance cross section, y: effective magnetic-path length), however the conventional trouble, the current which a direct-current superposition property deteriorates and is passed to a coil will not be made greatly. since the field of the coil section of a winding frame main part will become short on the other hand if the winding frame of a coil bobbin is only shortened and the effective magnetic-path length y is shortened, without it changes number of turns N --- an equivalent inductance --- obtaining --- in piles --- not winding --- it does not obtain, but \*\*\*\* will become thick and will be inevitably contrary to thin shape-ization

[0032] In the structure of the coil parts concerning this point and this invention, shortening of the aforementioned effective magnetic-path length y is attained without shortening the field of the coil section, and the above-mentioned trouble is solved. Although drawing 5 is an example which shows the relation of the value of the allowable-current value imax to a predetermined inductance value as a direct-current superposition property of coil parts, it turns out that the property (a) of the coil parts concerning this invention is improving with a clear significant difference as compared with the property (b) of the conventional article of these conditions.

[0033] Next, drawing 3 is the perspective diagram which looked at the coil bobbin 1 concerning this invention by which the coil 35 was wound around one layer from the rear face. In addition, in this example, the slitting slot 31 which derives a coil between a winding frame main part and a lead terminal is arranged in the base of pedestals 8 and 9 between each lead terminal.

[0034] With the above-mentioned coil bobbin 1, since the crevice as the passage section 13 which passes a coil 35 is established in the base 32 of the pedestal 14 of the middle fit-in frame 12, a roller and parallel understand that it is possible to pass a series for both the coil section by which the coil 35 was divided.

[0035] In addition, in this example, as long as the configuration of the passage section 13 of pedestal 14 bottom of a middle fit-in frame can pass a series, without crossing not only the shape of a concave like the aforementioned example but the stage, they may be other configurations.

[0036] Moreover, although the combination of a core was the EIE type structure which combined two E type cores and I type cores in this example, there are coil parts of the UIU type structure which combined two U type cores and I type cores as the second example. The magnetic leg fitted in a hole face to face is a magnetic leg of one way each of the core of two U type configurations. this --- fundamental --- within the limits of this invention --- it is --- fit-in of a coil bobbin almost of the same shape as the above-mentioned coil bobbin 1 --- It has the structure where a Japanese typeface-like closed magnetic circuit is formed, with the core of the I character configuration fitted in between two collars of the above-mentioned middle fit-in frame,

and detailed explanation is omitted below.

[0037] If it adds by way of precaution, it is distinct that the closed magnetic circuit of the type structure above-mentioned [ UIU ] consists of the shape of a mouth typeface as compared with the coil parts of the conventional UI type structure, the effective magnetic-path length  $y$  becomes short, and a direct-current superposition property improves.

[0038]

[Effect of the Invention] Since the coil parts concerning this invention are constituted as mentioned above, they have the outstanding effect that the coil parts of the highly efficient small and thin shape which is excellent in a direct-current superposition property, and has a big inductance are obtained, without increasing \*\*\*\*.

---

[Translation done.]

\* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] It is the decomposition perspective diagram showing the structure of the coil parts concerning this invention.
- [Drawing 2] It is the expansion perspective diagram which looked at the coil state near the heights at the base of a middle fit-in frame in this example from the base side.
- [Drawing 3] The state of the closed magnetic circuit of the coil parts concerning this invention in (A) and (B) are drawings showing the state of the closed magnetic circuit of the conventional coil parts, respectively.
- [Drawing 4] It is the perspective diagram which looked at the coil bobbin concerning this invention around which the coil was wound from the rear face.
- [Drawing 5] It is the direct-current superposition property view of the coil parts which expressed the inductance to the horizontal axis and expressed the allowable-current value to the vertical axis.
- [Drawing 6] It is the decomposition perspective diagram showing the structure of the conventional small transformer.
- [Drawing 7] It is the perspective diagram of the conventional small transformer.
- [Description of Notations]
- 1 Coil Bobbin
- 2 Winding Frame Main Part
- 3 Fit-in -- Hole
- 5 Six Fit-in frame
- 7 Pin Terminal
- 8 Nine Pedestal
- 10 11 Collar
- 12 Middle Fit-in Frame
- 13 (Coil) Passage Section
- 14 Pedestal
- 16 1 Type Core
- 17 18 E type core
- 19 20 Central magnetic leg
- 21 22 Side magnetic leg
- 30 Small Transformer
- 31 Slitting Slot
- 32 Base of Middle Fit-in Frame Pedestal
- 35 Coil
- 40 Small Transformer
- 41 Coil Bobbin
- 42 Winding Frame Main Part
- 43 Coil Section
- 44 Fit-in -- Hole
- 45 First Fit-in Frame

- 46 Second Fit-in Frame
- 47 First Pedestal
- 48 Second Pedestal
- 49 Pin Terminal
- 50 E Type Core
- 51 Central Magnetic Leg
- 52 Side Magnetic Leg

[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平6-196341

(43) 公開日 平成6年(1994)7月15日

(51) Int.Cl.<sup>5</sup>

H 0 1 F 31/00  
37/00

識別記号

庁内整理番号

8834-5E  
8834-5E

F I

技術表示箇所

審査請求 未請求 請求項の数 2 (全 7 頁)

(21) 出願番号 特願平4-342664

(22) 出願日 平成4年(1992)12月22日

(71) 出願人 000204284

太陽誘電株式会社  
東京都台東区上野6丁目16番20号

(72) 発明者 戒能大助

東京都台東区上野6丁目16番20号 太陽誘  
電株式会社内

(72) 発明者 小鹿学

東京都台東区上野6丁目16番20号 太陽誘  
電株式会社内

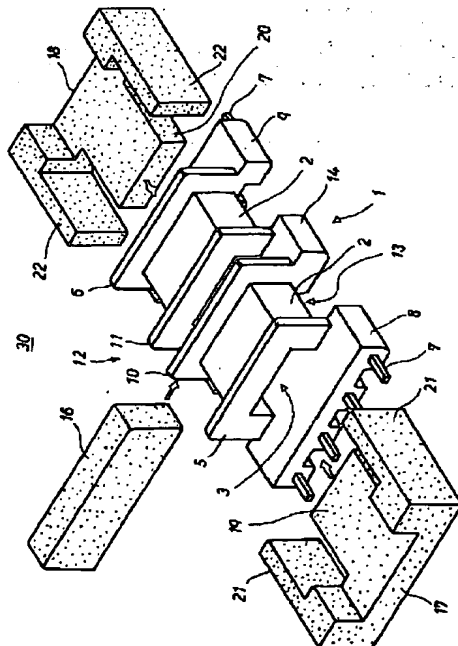
(74) 代理人 弁理士 羽鳥 亘

(54) 【発明の名称】 巻線部品

(57) 【要約】 (修正有)

【目的】 電子機器用の小型・薄型で高いインダクタンスを有する直流重畳特性の優れた高性能巻線部品を提供する。

【構成】 巻棒本体2の略中央にて巻線部を分断するとともに巻棒本体2を挟装して所定の間隔で平行に対峙する二つの鏑10、11で構成される中間嵌装棒12と、前記分断された双方の巻線部に巻線35を渡す渡り部13が底部に設けられた前記中間嵌装棒12を支持する基台14を有するコイルボビン1に、巻線を巻回後、前記中間嵌装棒12の基台14上に巻棒本体2の巻軸と直交するI字形の磁心16を前記二つの鏑10、11の間に嵌挿するとともに、二つのE字形の磁心17、18の各中央磁脚19、20を前記嵌挿孔3に向かい合わせに嵌挿することにより、物理的に両磁心の対応する中央磁脚19と20及び側磁脚21と22が各々I型磁心と物理的に接合して田字形の開磁路が形成された構造。





## 【特許請求の範囲】

【請求項1】 内側に磁心が嵌挿される嵌挿孔が形成されるとともに外側に巻線が捲回される巻線部を有する巻棒本体と、前記巻棒本体を両端にて挟装する嵌装枠と、これら両嵌装枠を各々支持するとともにピン端子が配設された基台と、前記巻棒本体の略中央にて巻線部を分断するとともに巻棒本体を挟装して所定の間隔で平行に対峙する二つの鏝で構成される中間嵌装枠と、前記分断された双方の巻線部に巻線を渡す渡り部が底部に設けられた前記中間嵌装枠を支持する基台と、を有するコイルボビンに、前記中間嵌装枠の基台上に巻棒本体の巻軸と直交するI字形の磁心を前記二つの鏝の間に嵌挿するとともに、二つのE字形の磁心の各中央の磁脚を前記嵌装孔に向かい合わせに嵌挿することにより、田字形の開磁路が形成されていることを特徴とする巻線部品。

【請求項2】 請求項1記載のコイルボビンの嵌挿孔に向かい合わせに嵌挿される磁脚が二つのU字形の磁心の各一方の磁脚であり、前記中間嵌装枠の二つの鏝の間に嵌挿されたI字形の磁心とともに日型形状の開磁路が形成されていることを特徴とする巻線部品。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 この発明は、電子機器の回路基板に実装する小型のトランス、チョークコイル等の巻線部品に関するものである。

## 【0002】

【従来の技術】 近年、電子機器等に対する小型・高性能化の消費者ニーズは強く、これに伴い電子回路基板に搭載される電子部品において比較的大きい容積を占める巻線部品であるトランスやチョークコイル等も小型・薄型化を図りつつ高性能化（高インダクタンス・高許容電流値）を求める声が強い。

【0003】 例えば、トランスはコンバーター、インバーター等で使用され、磁性材料等よりなる磁心を巻線が捲回されたコイルボビンに嵌装し、更に固定具等により固定することにより構成されており、必然的に電子回路基板に面実装される他の電子部品に比べて容積の大きい部品となっている。

【0004】 一方、巻線部品はその容積に比較してインダクタンス $L$ が大きく、且つ許容電流値 $i_{max}$ の大きいものが高性能巻線部品として求められているが、一般に所定の実効透磁率を有する磁性材料の磁心を用い、コイルの実効断面積が一定の場合、近似的に下記関係式が成り立つ。

$$【0005】 \quad (インダクタンス) \quad L = N^2 \cdot \mu_e \cdot A / y$$

但し、 $\mu_e$ ；実効透磁率、 $N$ ；巻数、 $A$ ；実効断面積、 $y$ ；実効磁路長

上記関係式から明らかなようにインダクタンス $L$ を大きくするにはコイルボビンに巻く巻線の巻数 $N$ を多くする

か、もしくは実効磁路長 $y$ を短くする必要がある。

【0006】 次に、従来の巻線部品構造の典型として小型トランスの構造を図6及び図7を基に詳述する。

【0007】 図6は上記従来の小型トランスのコイルボビン及び磁心の構造を示す分解斜視図である。

【0008】 図中、コイルボビン41は合成樹脂等を金型等により成形加工することにより形成されている。即ち、四角柱形状を有する巻棒本体42の外周部には、エナメル線等の巻線が捲回される巻線部43が設けられており、また内部には、磁心（例えば後述のE字形を有する磁心50の中央磁脚51）が嵌挿される嵌挿孔44が貫通形成されている。

【0009】 前記巻棒本体42の手前並びに後方には、それぞれ第一嵌装枠45及び第二嵌装枠46が前期巻棒本体2を挟装するように設けられており、然るに前記巻棒本体42、第一嵌装枠45及び第二嵌装枠46より略糸巻形状を形成している。

【0010】 この際、前記嵌挿孔44は、例えばコイルボビン41が一体成型されることより、第一嵌装枠45及び第二嵌装枠46にも開口形成される。

【0011】 更に、前記第一嵌装枠45及び第二嵌装枠46には、手前側に第一基台47が、また後方側に第二基台48がそれぞれ延設されており、各基台47、48の嵌挿孔方向の側面には、嵌挿孔3に平行な位置で該側面に直角にピン端子49が突設されている。

【0012】 一方、上記コイルボビン41に組み合わせる磁心50はE字形の磁心（以下、E型磁心とも称す。）であり、巻線を捲回後、このE型磁心50を二個向かい合わせにそれぞれの中央磁脚51が嵌挿孔44に嵌挿されるとともに、巻棒本体外側の側磁脚52も併せて互いに物理的に接合される。

【0013】 図7は小型トランス40の斜視図である。図において、小型トランス40はピン端子49を突設したコイルボビン41に巻線46を捲回して所定のピン端子にからげてある。次に、二つのE型磁心50の中央磁脚51をコイルボビン41の嵌挿孔44に向かい合わせに挿入し、また側磁脚52を巻線の外に位置させ、各々の側磁脚52の先端を物理的に接合した構造となっている（E型構造）。

【0014】 尚、上記E型磁心をU字形のU型磁心に置換したトランスも一般に利用されている（UU型構造）。

【0015】 更には、一方をE型磁心またはU型磁心として、他方をI字形のI型磁心として、巻棒本体の中央で接合するのでなく、一方の基台上で接合する構造のトランス（EI型、UI型構造）も開発されている。

## 【0016】

【発明が解決しようとする課題】 しかしながら、巻線部品の高性能化（高インダクタンス化）、小型・薄型化の要求に対して、実効透磁率 $\mu_e$ は使用磁心の材質（パー

3

マロイ、圧粉磁心、フェライト等)で決まり、巻数 $N$ を多くすると巻厚が厚くなり薄型化の要求に反することになる。

【0017】また、巻線部品においては直流重畳特性が問題になる。この直流重畳特性とは一般に直流電流を加えたときの特性値の変動をいうが、巻線部品においては、巻数 $N$ を増やすと該特性が劣化して電流があまり流れなくなる。所定のインダクタンス値に対する許容電流値 $i_{max}$ の値が巻線部品の直流重畳特性に相当する(図5参照)。

【0018】一方、実効磁路長 $y$ を短くすると巻棒本体の巻線部の領域が短くなるので巻数 $N$ を変えないで同等のインダクタンスを得るには重ねて巻回せざるをえず、必然的に巻厚が厚くなって薄型化に反することになってしまう。

【0019】本発明は、上記事情に鑑みてなされたものであり、小型・薄型化を図りつつ、高インダクタンスを得ることが可能な直流重畳特性に優れた巻線部品を提供するものである。

【0020】

【課題を解決するための手段】本発明は、内側に磁心が嵌挿される嵌挿孔が形成されるとともに外側に巻線が巻回される巻線部を有する巻棒本体と、前記巻棒本体を両端にて挟装する嵌装棒と、これら両嵌装棒を各々支持するとともにピン端子が配設された基台と、前記巻棒本体の略中央にて巻線部を分断するとともに巻棒本体を挟装して所定の間隔で平行に対峙する二つの鏝で構成される中間嵌装棒と、前記分断された双方の巻線部に巻線を渡す渡り部が底部に設けられた前記中間嵌装棒を支持する基台と、を有するコイルポビンに、前記中間嵌装棒の基台上に巻棒本体の巻軸と直交するI字形の磁心を前記二つの鏝の間に嵌挿するとともに、二つのE字形の磁心の各中央の磁脚を前記嵌装孔に向かい合わせに嵌挿することにより、田字形の閉磁路が形成されていることを特徴とする巻線部品を提供することにより、上記目的を達成するものである。

【0021】また、前記コイルポビンの嵌挿孔に向かい合わせに嵌挿される磁脚が二つのU型形状の磁心の各一方の磁脚であり、前記中間嵌装棒の二つの鏝の間に嵌挿されたI字形の磁心とともに日型形状の閉磁路が形成されていることを特徴とする巻線部品を提供することにより、上記目的を達成するものである。

【0022】

【作用】本発明においては、中間嵌装棒に設けられた所定の間隔で平行に対峙する二つの鏝は巻棒の巻線部を嵌挿孔とともに分断しているため、上記平行に対峙する二つの鏝の間に嵌挿されたI字形の磁心(以下I型磁心と称す)は物理的に嵌装孔に向かい合わせに嵌挿された二つのE字形の磁心の各中央の磁脚、及び側磁脚とともに田字形に接合して閉磁路を構成する。したがっ

4

て、磁路の分岐が可能となり、実効磁路長が短くなる。

【0023】また同様に二つのU型磁心とI型磁心との上記と同様の組み合わせで、日字形状の閉磁路が構成され、磁路の分岐が可能となり、実効磁路長が短くなる。

【0024】したがって、巻数を増やすことなく高いインダクタンスが得られるので優れた直流重畳特性が得られる。

【0025】さらに、中間嵌装棒基台の底部に分断された双方の巻線部に巻線を渡す渡り部が設けられているので、段差を生じることなく一連に巻線を両巻線部に巻回することが可能である。したがって、巻線を両巻線部に渡って巻回した場合、中間嵌装棒基台部分にて巻線がふくらんで巻厚が増すことはない。

【0026】

【実施例】本発明の実施例を、図面に基いて詳細に説明する。

【0027】図1は本発明に係わる巻線部品の例としての小型トランスの構造を示す分解斜視図、図2は同実施例において巻線を巻回し入出力端子にからげ、磁心を挿入して完成させた小型トランスの斜視図である。

【0028】両図面において、小型トランス30は、内側に磁心が嵌挿される嵌挿孔3が形成されるとともに外側に巻線が巻回される巻線部を有する巻棒本体2と、前記巻棒本体2を両端にて挟装する嵌装棒5、6と、これら両嵌装棒を各々支持するとともにピン端子7が配設された基台8、9と、前記巻棒本体2の略中央にて巻線部を分断するとともに巻棒本体2を挟装して所定の間隔で平行に対峙する二つの鏝10、11で構成される中間嵌装棒12と、前記分断された双方の巻線部に巻線35を渡す渡り部13が底部に設けられた前記中間嵌装棒12を支持する基台14と、を有するコイルポビン1に、巻線35を巻回後、前記中間嵌装棒12の基台14上に巻棒本体2の巻軸と直交するI字形の磁心16を前記二つの鏝10、11の間に嵌挿するとともに、二つのE字形の磁心17、18の各中央磁脚19、20を前記嵌挿孔3に向かい合わせに嵌挿することにより、物理的に両磁心の対応する中央磁脚19と20及び側磁脚21と22が各々I型磁心と物理的に接合して田字形の閉磁路が形成された構造となっている。尚、前記コイルポビン1は、例えばフェノール樹脂等を材質としており、該合成樹脂を金型等により成型加工することにより一体形成される。

【0029】上記構造の小型トランス30においては、図4の(A)の各磁心が組み合わされた平面図から明らかなようにI型磁心16が介されることによって閉磁路が分岐して、実効磁路長 $y$ が短くなることが解る。比較として同図(B)に従来のE型構造の小型トランス40の実効磁路長 $y'$ を示す。

【0030】前述のように巻線部品がその容積に比較してインダクタンス $L$ が大きく、且つ許容電流値 $i_{max}$

の大きいものが高性能巻線部品として求められている現在、一般に所定の実効透磁率を有する磁性材料の磁心を用い、小型・薄型化のためコイルの実効断面積が大きできない条件の元では、下記近似式において明らかなように、インダクタンス $L$ を大きくするにはコイルボビンに巻く巻線の巻数 $N$ を多くするか、もしくは実効磁路長 $y$ を短くする方法がある。

$$【0031】 \quad (インダクタンス) \quad L = N^2 \cdot \mu e \cdot A / y$$

(但し、 $\mu e$  ; 実効透磁率、 $N$  ; 巻数、 $A$  ; 実効断面積、 $y$  ; 実効磁路長) しかしながら、従来の問題点で指摘したとおり、巻数 $N$ を増やすと直流重畳特性が劣化して巻線に流す電流が大きできない。一方、単にコイルボビンの巻枠を短くして実効磁路長 $y$ を短縮すると巻枠本体の巻線部の領域が短くなるので巻数 $N$ を変えないで同等のインダクタンスを得るには重ねて捲回せざるをえず、必然的に巻厚が厚くなって薄型化に反することになってしまう。

【0032】 この点、本発明に係わる巻線部品の構造においては、巻線部の領域を短くすることなしに前記実効磁路長 $y$ の短縮が可能となつて、上記問題点が解決される。図5は巻線部品の直流重畳特性として所定のインダクタンス値に対する許容電流値 $i_{max}$ の値の関係を示す一例であるが、同条件の従来品の特性((b))と比較して本発明に係わる巻線部品の特性(a)が明らかな有意差をもって向上していることが解る。

【0033】 次に、図3は巻線35が一重に捲回された本発明に係わるコイルボビン1を裏面から見た斜視図である。尚、本実施例では基台8、9の底面には巻枠本体とリード端子間に巻線を導出する切り込み溝31が各リード端子間に配設されている。

【0034】 上記コイルボビン1では、中間嵌装枠12の基台14の底面32に巻線35を渡す渡り部13としての凹部が設けられているので、巻線35が分断された両巻線部を巻軸と平行に一連に渡すことが可能であることが解る。

【0035】 尚、本実施例において、中間嵌装枠の基台14底部の渡り部13の形状は前記実施例のような凹形状に限らず、段を越えることなく一連に渡すことが可能であれば他の形状であつてもよい。

【0036】 また、本実施例において磁心の組み合わせは二つのE型磁心とI型磁心を組み合わせたEIE型構造であったが、第二の実施例として二つのU型磁心とI型磁心を組み合わせたUIU型構造の巻線部品がある。これも基本的に同発明の範囲内であつて、前述のコイルボビン1とはほぼ同形のコイルボビンの嵌挿孔に向かい合わせに嵌挿される磁脚が二つのU型形状の磁心の各一方の磁脚であり、前述の中間嵌装枠の二つの鐳の間に嵌挿されたI字形状の磁心とともに日字形状の閉磁路が形成される構造となつており、以下詳細な説明は省略する。

【0037】 念のため付言すれば、従来のUU型構造もしくはUI型構造の巻線部品と比較して上記UIU型構造の閉磁路が口字形状から日字形状となつて実効磁路長 $y$ が短くなり、直流重畳特性が向上するのは明らかである。

#### 【0038】

【発明の効果】 本発明に係わる巻線部品は上記のように構成されているため、巻厚を増やすことなく直流重畳特性に優れ、且つ大きなインダクタンスを有する高性能な小型・薄型の巻線部品が得られるという優れた効果を有する。

#### 【図面の簡単な説明】

【図1】 本発明に係わる巻線部品の構造を示す分解斜視図である。

【図2】 同実施例における中間嵌装枠底面の凸部付近の巻線状態を底面側から見た拡大斜視図である。

【図3】 (A) は本発明に係わる巻線部品の閉磁路の状態、(B) は従来の巻線部品の閉磁路の状態をそれぞれ示す図である。

【図4】 巻線が捲回された本発明に係わるコイルボビンを裏面から見た斜視図である。

【図5】 横軸にインダクタンス、縦軸に許容電流値を表した巻線部品の直流重畳特性図である。

【図6】 従来の小型トランスの構造を示す分解斜視図である。

【図7】 従来の小型トランスの斜視図である。

#### 【符号の説明】

- |       |            |
|-------|------------|
| 1     | コイルボビン     |
| 2     | 巻枠本体       |
| 3     | 嵌挿孔        |
| 5、6   | 嵌装枠        |
| 7     | ピン端子       |
| 8、9   | 基台         |
| 10、11 | 鐳          |
| 12    | 中間嵌装枠      |
| 13    | (巻線) 渡り部   |
| 14    | 基台         |
| 16    | I型磁心       |
| 17、18 | E型磁心       |
| 19、20 | 中央磁脚       |
| 21、22 | 側磁脚        |
| 30    | 小型トランス     |
| 31    | 切り込み溝      |
| 32    | 中間嵌装枠基台の底面 |
| 35    | 巻線         |
| 40    | 小型トランス     |
| 41    | コイルボビン     |
| 42    | 巻枠本体       |
| 43    | 巻線部        |
| 44    | 嵌挿孔        |

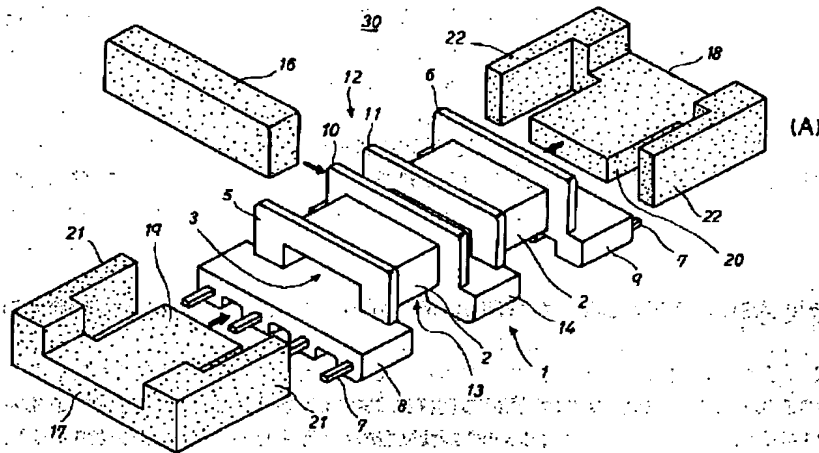
(5)

特開平6-196341

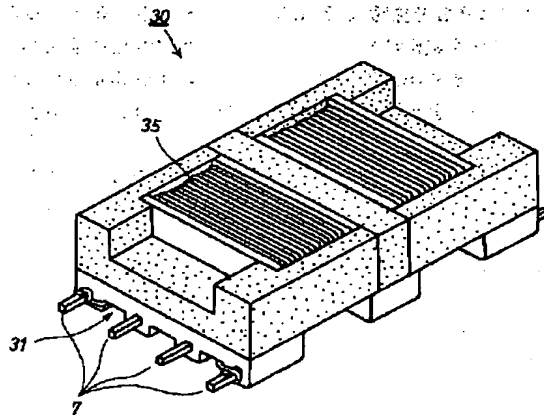
45 第一嵌装枠  
46 第二嵌装枠  
47 第一基台  
48 第二基台

49 ピン端子  
50 E型磁心  
51 中央磁脚  
52 側磁脚

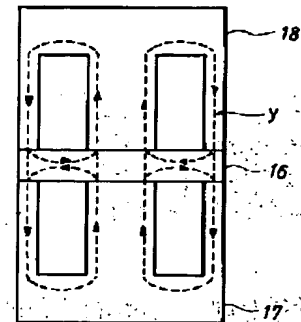
【図1】



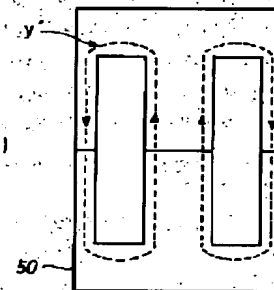
【図2】



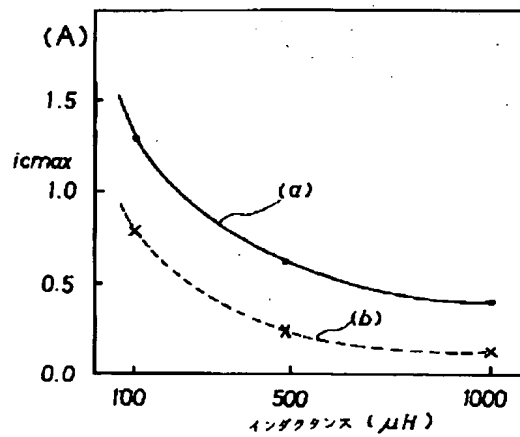
【図4】



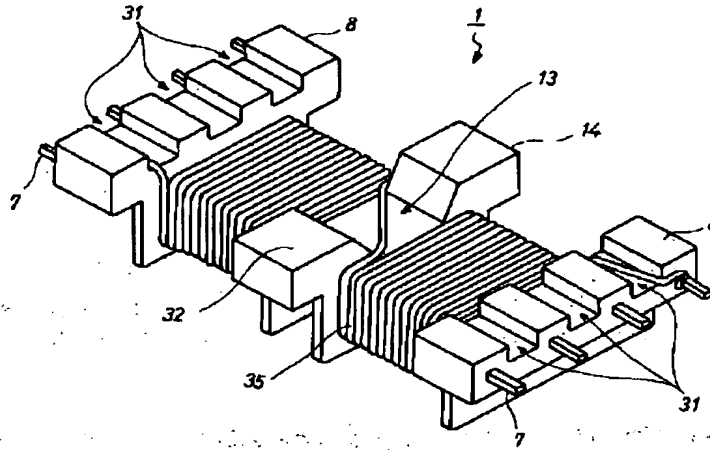
(B)



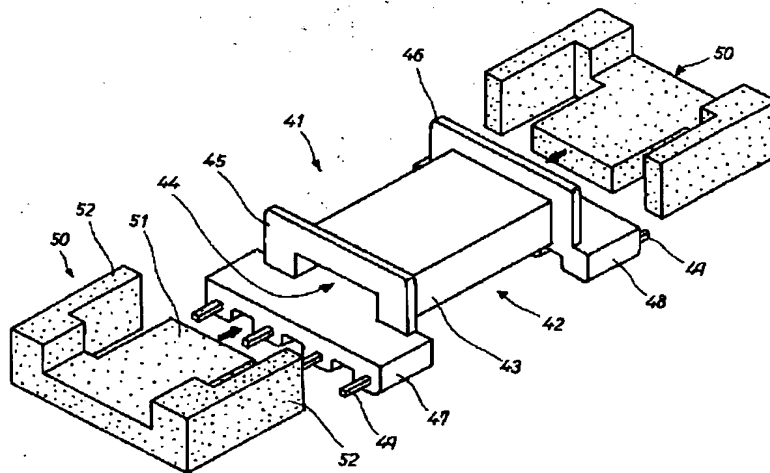
【図5】



【図3】



【図6】



(7)

特開平6-196341

【図7】

